Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

AN OUT-DOOR EQUIPMENT FOR COLLEGE WORK IN BIOLOGY.

JAMES G. NEEDHAM.

THE study of living nature is chiefly manifest at the two extremes of our educational system in the establishment of public school gardens and university summer laboratories. Of what is being done in this line between the grades and the graduates less is heard. Perhaps it is because the high school and the college are less prone to advertise themselves by novelties in their educational programs: perhaps, because they are seeking to develop new methods instead of creating them full fashioned outright.

Thus far, the grades that have acquired good school gardens seem to have the better of it. For, besides having established an inexhaustible and ever accessible base of supplies for nature study work, they have at the same time set the pupils enthusiastically to educating themselves, and by the historic method — by doing over again in the garden such work as was done when the mental fibre of the race was first toughening.

The situation in high schools seems less fortunate. While many of them have books outlining ecological phenomena, very few of them have proper opportunity for the study of such phenomena. The grounds of the average high school are the most drear and barren waste within the city limits. The life that belongs to the soil has been exterminated. Only trees are cultivated, and these are not often native trees. The birds are English sparrows: the animals are stray cats, mice and roaches. If there be parks in the city no natural assemblage of native plants and animals is to be found therein: for the taste of the average town has not evolved beyond the painting-the-lily stage. By means of long rides on street cars at infrequent and uncertain intervals classes are taken out to see some remnants of nature and are shown things. The best thing found is often fresh air. How far this falls short of the individual work that may be done in the school garden or at the laboratory table! The too common result of giving suggestions for seeing things that there is no opportunity for seeing is a relapse to book-and-recitation methods.

The field laboratories of the universities offer for the most part excellent opportunities both in natural environment and in facilities for its study; but these are far from home and available only in the summer vacation, and the rank and file of university students miss altogether the sort of training they afford.

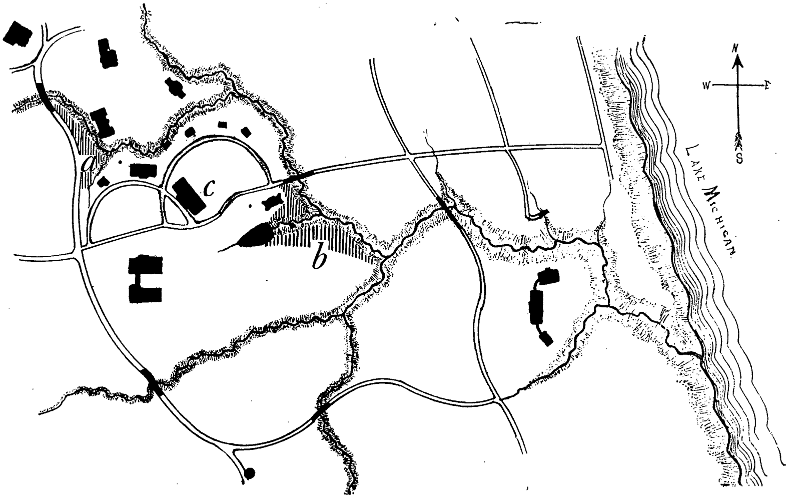

Fig. 1.

Very little is heard of the movement toward the utilization of living nature in college work, yet it is exerting a powerful influence over present methods. The anatomical work which was the beginning, the continuation and the end of the old time courses laid out by morphologists — and morphologists must be given credit for having laid out the first practical laboratory courses — no longer monopolizes all the time of the general student. The elements of biology that make for culture are far from being confined to the dissecting table. And more and more college students are being encouraged to study nature in the field and by those methods that in the last century yielded our most important generalizations.

This article is intended to set forth some of the ways in which living nature is utilized at Lake Forest College, where the work is not that of a summer season spent far from home, but that of daily college life, done about the doors of the college halls; not the research work of graduates, but the general-culture work of undergraduates; not for the few who can afford it, but for the many who need it.

The plan here has been to use things near at hand. In a large measure, therefore, the situation accounts for the things that have been done. The accompanying map (Fig. 1) of the campus and its immediate environs shows some of the determining physiographic conditions. The campus is situated on the scarcely perceptible eastward slope of a terminal moraine, which parallels the shore of Lake Michigan, and is covered with fine oak woods. It is intersected by sharp ravines that have been cut by puny postglacial streams. The ravine shown in the map is scarcely more than a mile in length, and attains a depth of about 70 ft. where it reaches the lake level at its mouth. On the ridge at the head of these streams is a series of shallow ponds, many of them temporary, and some of them doubtless occupying old "buffalo wallows." Half a mile farther westward the Skokie winds its leisurely course through the marshes at the foot of the more abrupt westward slope of the moraine. The Skokie and its marshes, the ponds, the upland woods, the ravines, the crumbling outer face of the "bluff" and the Lake Michigan beach, each furnishes its own peculiar fauna and flora, and all are within easy walking distance of the campus. But the woods, the ravines, and an artificial pond are upon the campus, and are as easily entered for study as are the laboratories: and, naturally, these are most used. In the map *c* is college hall, the building in which the biological laboratories are located, and *p* is the pond — perhaps the most important single feature of biological equipment — a veritable aquarium, permanently stocked and self sustaining — teeming with a multitude of forms of animal and plant life. Its proximity may be judged from the view shown in the first figure of the plate, which view was taken from the window of the general laboratory. The heavily shaded portions of the campus (*a* and *b*) comprising sev-

The campus pond.

Washing down a catch.

The winter house.

eral acres extent, have been set apart by the trustees for the purposes of a biological garden. Both plots are wooded and traversed by deep ravines. Plot *a* being at the front of the campus is to be used chiefly for ornamental planting of native shrubs and trees. Plot *b* is more secluded, and is more freely used for the ends of biological instruction. It contains the pond, and the winter house shown in the third figure of the plate. Its ravines exhibit, especially on the shady side, a luxuriant tangle of shrubbery and vines, of flowers and ferns, so little disturbed by civilizing influences that the native *Cypripedium reginæ* and *Adiantum pedatum* — usually the first victims of their loving friends — still flourish there abundantly. The first thing done in this plot was taking measures to preserve the native species still present, and to restore to it a number that had been already exterminated. The next thing, was the assembling of those biological and ecological types especially useful for illustration in general course work. Plants are raised here not for themselves alone but for the sustenance they afford to the forms of animal life desired to be retained with them. Care has been taken to provide a constant succession of wild fruits for birds, the proper plants to sustain aphid colonies with change of hosts, and for the food of particular animal species — even for a solitary aboriginal family of woodchucks. Thus, where nature had done much, and where the material needed was all near at hand, attention has been given to making things as readily available for study in the field as they are in the laboratory, to the end that field studies that are really worth while might be undertaken.

But two things that are obviously artificial have as yet been introduced into the garden: a plankton apparatus and a winter house. Probably no college teacher has witnessed a good plankton catch at a summer laboratory or field station without wishing that such quantities and variety of the simpler organisms might be available for his class-room work. Many of them may be obtained, to be sure, with any simple sort of towing net; but an apparatus that will get all the life at a definite depth and serve for quantitative measurement of it has generally been accounted too complicated and too expensive for the equipment of an average college. But an apparatus that will do all these things and that will gather in a few minutes use more plankton than can be even qualitatively examined in a laboratory period, was constructed by several student assistants a Lake Forest College at a cost of about ten dollars.

The exterior of the apparatus is shown in Fig. 2 and the net itself is seen in the second figure of the plate. A net of the usual form was made of no. 20 silk bolting cloth. A large milk can with loose breast and heavy steel cap was used to sustain the net and to hold the slack water in which it should rest while receiving the inflow stream. The net itself is suspended from two perforated circular brass strips soldered within the upper and lower edges respectively of the breast. To a short tube inserted into one side of the breast is attached the waste pipe *q*. The intake pipe *r* is attached to the cap; but a three-way cock is inserted in the couplings at *c*, and a short pipe *p* is attached to its lateral aperture, with a spray nozzle on the end. The cock may be turned so as to stop the flow altogether or to direct the stream laterally through the spray pipe *q* (as shown in action in the second figure of the plate) or to direct it through the cap

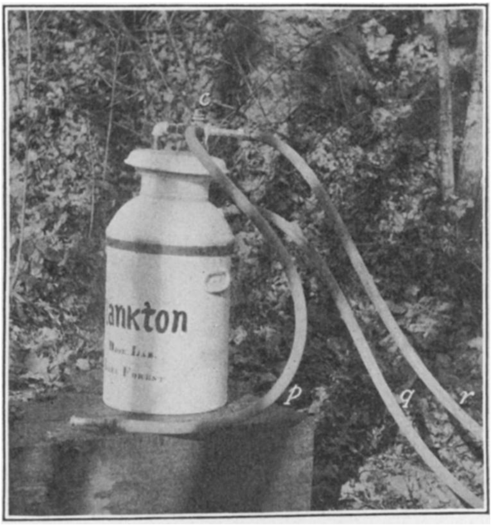

FIG. 2.— A simple plankton apparatus.

into the net and out through the overflow pipe *q*. The rate of flow is readily measured at the end of the overflow pipe *q*. The net is placed for use on a platform at the foot of the dam that confines the campus pond and the water is brought to it by siphoning over the dam with a long garden hose. The upper end of the hose is fitted with a funnel-shaped, screen covered intake, and this can be held in any position and at any depth as long as desired. The flow is perfectly uniform, even such active and light loving forms as Corethra and Corixa being readily taken down the pipe. This simple apparatus has made itself an indispensable adjunct to the work of several courses. Its use at once revealed the presence of vast numbers of Dinobryon, Notholca, Polyarthra, etc., not previously known to exist in the pond.

Near to the plankton platform in the ravine is the winter house, in which are kept the plankton and other field apparatus and garden tools. Here are proper quarters also, for live animals desired for study during the winter: tanks in the floor for salamanders, frogs, crayfishes, earthworms; shorts-bins on the wall for meal worms, sand beds for seeds and for plant cuttings, etc. This most useful little house, shown in the third figure of the plate, was built to fit the landscape and not to disfigure it.

Individual apparatus for field work is much more simple. Air and water nets, cyanide bottles, jars and vials, garden trowels, etc., are supplied every student; for field work at Lake Forest is just as individual as is laboratory work, and just as definite results are expected from it. How much less expensive is this out door equipment than the indoor equipment that all the colleges have!

But the first requisite of satisfactory field work on the part of college students is neither books nor apparatus, but living nature near at hand. Fortunately, the native plants that are needed will grow near at hand, if given room, and their natural animal associates — at least those most useful for study — will come and dwell again with them. Fortunately, also, they may be made to add both beauty and interest to the grounds devoted to them. Though the environment at Lake Forest is exceptionally favorable for all this sort of work, it is to be borne in mind that nine tenths of what is undertaken here could, with proper provision, be done anywhere. Ecological types are as widely distributed and as available for study in different places as are morphological types: and biological phenomena are as tangible and as real as are systematic, while certainly not of less interest or educational value.

BIOLOGICAL DEPARTMENT,
Lake Forest College.